

U.S. Serial No. 10/069,321
Reply to Office Action of: July 9, 2003
Family Number: P1999S004

Page 2 of 14

AMENDMENT TO THE CLAIMS

1. (currently amended) A lubricating oil of reduced crystal formation potential wherein the crystal formation is attributable to the interaction of sulfur-phosphorus containing anti-wear/extreme pressure agents and hindered phenolic antioxidants, the lubricating oil comprising a major amount of a base oil of lubricating viscosity and having less than about 99 wt% saturates content, and a minor amount of additive comprising a sulfur-phosphorus containing anti-wear/extreme pressure additive of the type which will interact with hindered phenol antioxidant to produce crystals, a hindered phenol antioxidant and a high molecular weight di- or poly-carboxylic acid, anhydride or mixture thereof provided at least 0.0013 wt% high molecular weight di- or poly- carboxylic acid, anhydride or mixture thereof is present for each 1 ppm phosphorus attributable to the sulfur-phosphorus containing anti-wear/extreme pressure agent.

2. (currently amended) The lubricating oil of claim 1 wherein the sulfur-phosphorus containing anti-wear/extreme pressure agent is in an amount sufficient to provide about 2 ppm to 320 ppm phosphorus, the hindered phenol antioxidants is at a concentration of from about 0.01 to 2.0 wt% based on active ingredient and the high molecular weight di- or poly-carboxylic acid, anhydride or mixture thereof is at a concentration of in the range of about 0.0026 to 0.8 wt% based on active ingredient.

3. (currently amended) The lubricating oil of claim 1 or 2 wherein the sulfur-phosphorus containing anti-wear/extreme pressure agent is in an amount sufficient to provide from 40 ppm to 200 ppm phosphorus.

4. (currently amended) The lubricating of claim 1 or 2 wherein the sulfur-phosphorus containing anti-wear/extreme pressure agent is in an amount sufficient to provide from 80 ppm to 130 ppm phosphorus.

U.S. Serial No. 10/069,321
Reply to Office Action of: July 9, 2003
Family Number: P1999S004

Page 3 of 14

5. (currently amended) The lubricating oil of any preceding claim 1, 2, 3 or 4 wherein the hindered phenol is at a concentration of about 0.1 to 1.0 wt% based on active ingredient.

6. (currently amended) The lubricating oil of claim 1, 2, 3 or 4 wherein the hindered phenol is at a concentration of about 0.3 to 0.5 wt% based on active ingredient.

7. (original) The lubricating oil of claim 2, 3 or 4 wherein the high molecular weight di- or poly-carboxylic acid, anhydride or mixture thereof is at a concentration of about 0.08 to 0.4 wt% based on active ingredient.

8. (currently amended) The lubricating oil of any preceding claim 3 or 4 wherein the high molecular weight di- or poly-carboxylic acid, anhydride or mixture thereof is at a concentration of about 0.12 to 0.24 wt% based on active ingredient.

9. (currently amended) The lubricating oil of any preceding claim 1, 2, 3 or 4 wherein the high molecular weight di- or poly- carboxylic acid, anhydride or mixture thereof is a polyhydrocarbylene substituted di- or poly-carboxylic acid, anhydride or mixture thereof wherein the polyhydrocarbylene group has a molecular weight in the range of 300 to 5,000.

10. (currently amended) A method for reducing crystal formation in lubricating oil containing a mixture of sulfur-phosphorus anti-wear/extreme pressure agent and hindered phenols phenol antioxidant wherein the production of the crystals is due to the interaction between the particular sulfur-phosphorus anti-wear/extreme pressure agent interacts with and the phenolic antioxidant to produce crystals, such method comprising adding to a mixture comprising a major amount of a base oil of lubricating viscosity having a saturates content of less than 99 wt%, and a minor amount

U.S. Serial No. 10/069,321
Reply to Office Action of: July 9, 2003
Family Number: P1999S004

Page 4 of 14

of additives comprising a the particular sulfur-phosphorus containing anti-wear/extreme pressure agent a and the hindered phenol antioxidant which otherwise interact to form crystals, and a high molecular weight di- or poly-carboxylic acid, anhydride or mixture thereof provided at least 0.0013 wt% of the high molecular weight di- or poly-carboxylic acid, anhydride or mixture thereof is used for each 1 ppm phosphorus attributable to the sulfur-phosphorus containing anti-wear/extreme pressure agent.

11. (new) The method of claim 10 wherein the sulfur-phosphorus anti-wear/extreme pressure agent is in an amount sufficient to provide about 2 ppm to 320 ppm phosphorus, the hindered phenol antioxidant is at a concentration of from about 0.01 to 2.0 wt% based on active ingredient and the high molecular weight di- or poly-carboxylic acid is at a concentration of in the range of about 0.0026 to 0.8 wt% based on active ingredient.

12. (new) The method of claim 10 wherein the sulfur-phosphorus containing anti-wear/extreme pressure agent is in an amount sufficient to provide from 40 ppm to 200 ppm phosphorus.

13. (new) The method of claim 10 wherein the sulfur-phosphorus containing anti-wear/extreme pressure agent is in an amount sufficient to provide from 80 ppm to 130 ppm phosphorus.

14. (new) The method of claim 11, 12 or 13 wherein the high molecular weight di- or poly-carboxylic acid, anhydride or mixture thereof is at a concentration of about 0.08 to 0.4 wt% based on active ingredients.

15. (new) The method of claim 12 or 13 wherein the high molecular weight di- or poly-carboxylic acid, anhydride or mixture thereof is at a concentration of about 0.12 to 0.24 wt% based on active ingredient.

U.S. Serial No. 10/069,321
Reply to Office Action of: July 9, 2003
Family Number: P1999S004

Page 5 of 14

16. (new) The method of claim 10, 11, 12 or 13 wherein the hindered phenol is at a concentration of about 0.1 to 1.0 wt% based on active ingredient.

17. (new) The method of claim 14 wherein the hindered phenol is at a concentration of about 0.1 to 1.0 wt% based on active ingredient.

18. (new) The method of claim 15 wherein the hindered phenol is at a concentration of about 0.1 to 1.0 wt% based on active ingredient.

19. (new) The method of claim 10, 11, 12 or 13 wherein the hindered phenol is at a concentration of about 0.3 to 0.5 wt% based on active ingredient.

20. (new) The method of claim 14 wherein the hindered phenol is at a concentration of about 0.3 to 0.5 wt% based on active ingredient.

21. (new) The method of claim 15 wherein the hindered phenol is at a concentration of about 0.3 to 0.5 wt% based on active ingredient.

22. (new) The method of claim 10, 11, 12 or 13 wherein the high molecular weight di- or poly-carboxylic acid, anhydride or mixtures thereof is a polyhydrocarbylene substituted di- or poly-carboxylic acid, anhydride or mixture thereof wherein the polyhydrocarbylene group has a molecular weight in the range 300 to 5,000.

23. (new) The method of claim 17 wherein the high molecular weight di- or poly-carboxylic acid, anhydride or mixtures thereof is a polyhydrocarbylene substituted di- or poly-carboxylic acid, anhydride or mixture thereof wherein the polyhydrocarbylene group has a molecular weight in the range 300 to 5,000.

U.S. Serial No. 10/069,321
Reply to Office Action of: July 9, 2003
Family Number: P1999S004

Page 6 of 14

24. (new) The method of claim 18 wherein the high molecular weight di- or poly-carboxylic acid, anhydride or mixtures thereof is a polyhydrocarbylene substituted di- or poly-carboxylic acid, anhydride or mixture thereof wherein the polyhydrocarbylene group has a molecular weight in the range 300 to 5,000.

25. (new) The method of claim 20 wherein the high molecular weight di- or poly-carboxylic acid, anhydride or mixtures thereof is a polyhydrocarbylene substituted di- or poly-carboxylic acid, anhydride or mixture thereof wherein the polyhydrocarbylene group has a molecular weight in the range 300 to 5,000.

26. (new) The method of claim 21 wherein the high molecular weight di- or poly-carboxylic acid, anhydride or mixtures thereof is a polyhydrocarbylene substituted di- or poly-carboxylic acid, anhydride or mixture thereof wherein the polyhydrocarbylene group has a molecular weight in the range 300 to 5,000.

27. (new) The lubricating oil of claim 7 wherein the high molecular weight di- or poly- carboxylic acid, anhydride or mixture thereof is a polyhydrocarbylene substituted di- or poly-carboxylic acid, anhydride or mixture thereof wherein the polyhydrocarbylene group has a molecular weight in the range of 300 to 5,000.

28. (new) The lubricating oil of claim 8 wherein the high molecular weight di- or poly-carboxylic acid, anhydride or mixture thereof is a polyhydrocarbylene substituted di- or poly-carboxylic acid, anhydride or mixture thereof wherein the polyhydrocarbylene group has a molecular weight in the range of 300 to 5,000.